

EXHAUST STEAM GENERATOR

The fully packaged ESG1 is selected from 48 pre-engineered standard models with output capabilities of 20 to 500 boiler hp and operating steam pressures from 3 to 450 psig. The ESG1 is shipped complete, ready for operating as either a primary or supplementary steam source.

The ESG1 package is made up of three basic sections:

- finned tube heat transfer section
- steam flash circulating drum assembly
- modulating full port exhaust bypass system

Full operating steam pressure from a cold start in less than 10 minutes.

OPERATION & CONTROL

The integral forced circulating water pump continually circulates high temperature water from the steam flash drum assembly to the heat transfer core assembly. Btu is transferred from the exhaust to a high flow superheated water/steam mixture. The super-heated water is returned to the steam drum which contains dry pipe, baffles, and lance assemblies, where it flashes into 99% dry steam as it exits out to the system.

As the water is generated into steam and exits the boiler, the modulating boiler feedwater system controls continuous feedwater flow for constant drum water level control. Fail safe controls are built in for full exhaust bypass in the event of electrical or pneumatic loss.

The steam pressure controller maintains the operating steam pressure as it controls the modulating exhaust bypass assembly. This provides solid operating steam pressure under various operating steam load demands.



QUALITY CONTROL

The ESG1 is manufactured, tested, and stamped in accordance with the requirements of Section I of the ASME Boiler and Pressure Vessel Code, and National Board. Boiler trim includes all safety controls and alarms to meet state and federal codes. Final assembly, electrical wiring, and factory adjustments are completed under a strict set of guide lines.

Engine Exhaust Application

- Capacity: 400kW – 7MW
- Entering gas temps: 600 – 1,600°F
- Heat sink types: Supplemental steam demand and/or primary steam source for steam heating or process steam.

OPTIONAL COMPONENTS



Continuous Blowdown with Intermittent Conductivity Sampling Assembly

Maximize boiler efficiency by periodically sampling surface blowdown water and controlling total dissolved solids. Maintaining optimal levels of concentrations will control the costs of water, energy, and chemicals. Assembly includes: motorized valve, probe, and piping assembly.



Hinged Access Door for full heating surface inspection

Hinged access doors are considered when firing with fuel oil and/or incomplete combustion requiring full access on a regular basis for manual cleaning. A hinged access door can be incorporated for 100% finned tube viewing and attention.

Automatic Sootblower

Sootblowers are available either as a manual push button start or fully automatic with timed sequencing. Sootblowers are considered when firing with fuel oil and/or incomplete combustion. Sootblowers are also considered when manual cleanings are not feasible in order to maintain peak performance.



FEATURES

The ESG1 is an easy choice when compared to the "old technology" of a conventional firetube boiler:

- Completely self-contained "package" design reduces engineering, installation and maintenance costs.
- Size requires only 1/2 the floor space and 1/2 the weight of conventional boilers, which reduces building size, structural support costs, and shipping costs.
- Ease of tube replacement requires no overhead cranes, special rigging, special crews, or extra roof height above the unit, while reducing down time.
- Many shapes and sizes are available to fit limited space and maintain performance requirements.
- Produces greater than 99% dry steam.
- Provides 100% turndown capability.
- 5-10 minute time from startup to full output.
- Integrated exhaust modulating bypass for safe automatic steam control.
- Explosion-proof heat transfer exchanger.
- Low friction loss for minimum static exhaust back pressure.
- High circulating flow to minimize scale buildup.
- No thermal expansion concerns with cold boiler feedwater.
- Performance aimed at the lowest pinch point in the industry, (final leaving exhaust temperature minus operating steam temperature) for maximum thermal efficiency.

MINIMUM CONNECTIONS

The ESG1 requires only the following connections for a cost effective installation:

- steam outlet
- exhaust flange inlet and outlet
- single main power
- single main blowdown
- feedwater inlet
- pneumatic control air
- cooling water inlet and outlet



HOSPITAL, Renton, Washington
 (4) Model ESG1-616B19CSS
 Recovering Btu from (4) Jenbacher JMS-320, 900kW natural gas engines.
 Reducing each 2,498 SCFM from 977°F to 392°F.
 Delivering 1,863 pph steam @ 90 PSI operating (150 PSIG design).



WATER PURIFICATION PLANT, Burlington, Ontario
 Model ESG1-A12D18CSS
 Recovering Btu from a Caterpillar 3516, 800kW natural gas engine. Reducing 2,382 SCFM from 770°F to 344°F.
 Delivering 1,277 pph steam @ 130 PSI operating (150 PSIG design).

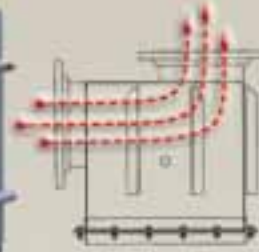


HOSPITAL, Chicago, Illinois
 (3) Model ESG1-616B18CSS.
 Recovering Btu from (3) Waukesha 3516, 1,100kW natural gas engines.
 Reducing each 2,392 SCFM from 1,135°F to 438°F.
 Delivering 2,173 pph steam @ 130 PSI operating (150 PSIG design).

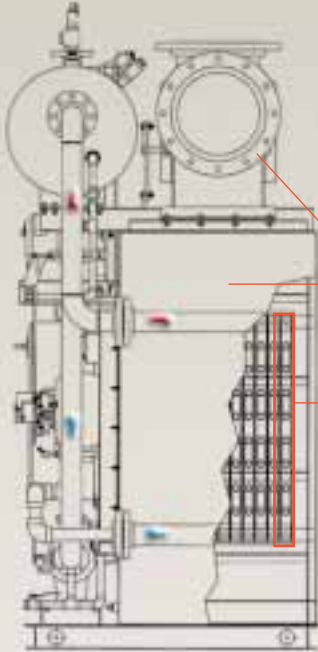


**ESG1 SERIES
FOR: THE COMPLETE
STEAM GENERATION
PACKAGE**

**ASME & National Board
stamped - Section 1**



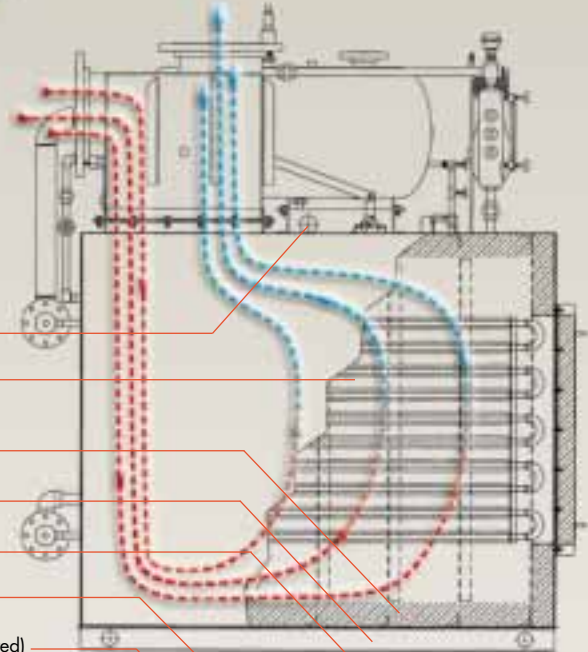
EXHAUST FLOW:
FULL BYPASS
POSITION



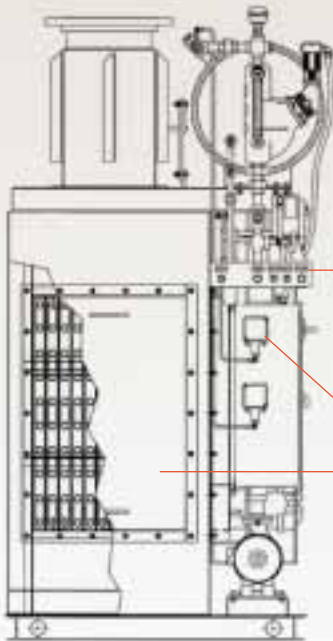
Header View

EXHAUST FLOW:
FULL OPERATING
POSITION

- Modulating exhaust bypass
- 10Ga. carbon steel exterior
- Lifting eye
- Finned tube heat transfer section
(removable finned tube rack assy)
- High temperature insulation block
- Structural steel base
- ASME Steam safety valve
- Steam outlet flange
- Steam flash drum assembly (insulated)



Back View



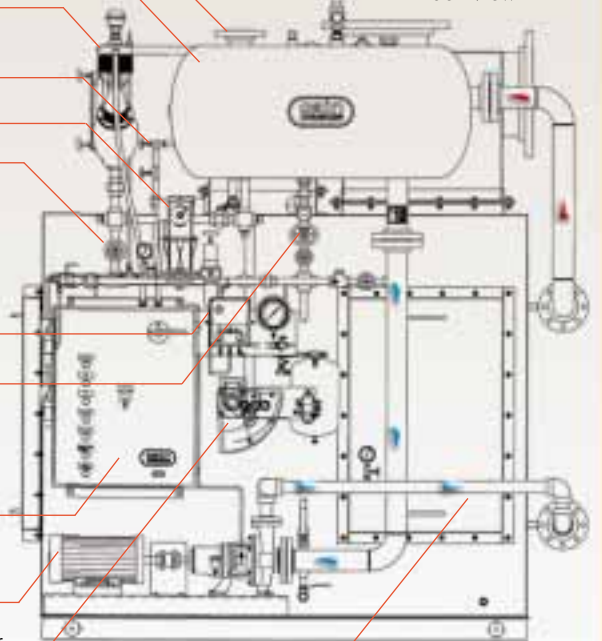
Door View

- Water level controller with
low & high water cutout
- Continuous surface blowdown
- Modulating feedwater valve
- Water level blowdown
- Localized piping connections:
- Feedwater
- blowdown manifold
- 100psig control air
- circulating pump cooling water
- Steam pressure controller
- Main blowdown valve assembly
- Excess steam pressure switch
- Tube removal access door

NEMA 12 control panel:
Fuse disconnect, Magnetic starter,
Stepdown transformer, Alarm lights

- Circulating pump assembly
- Pneumatic modulating damper actuator

Main inspection door



Front View

ESG1: SPECIFICATION

The following is a general specification, shown as a guide for design and construction.

1.0 General Design:

- 1.1 The ESG1 shall be a packaged forced circulation coil design, manufactured and tested in accordance with the requirements of Section 1, of the ASME Boiler and Pressure Vessel Code, and stamped at 150 PSIG (15 to 450 PSIG available) to the appropriate Section. The operating pressure shall be _____ PSIG.
- 1.2 The ESG1 shall have the capacity to operate automatically as a supplemental or primary steam generator. It shall be designed to produce full steam output in approximately 10 minutes from a cold start and to operate fully automatic under fluctuating steam loads and/or exhaust volumes.

2.0 General Construction:

- 2.1 The design shall be made up of three basic sections mounted on a structural steel skid, pre-piped, wired for ease of installation, requiring no field assembly.
- 2.2 The sections shall include a finned tube heating surface, modulating full port exhaust bypass, and steam flash drum assembly, as standard components.
- 2.3 An integral circulating pump shall also serve to circulate water from the heat transfer section back to the steam flash drum assembly.
- 2.4 All water, air, and blowdown connections shall be localized within a common manifold assembly for ease of the piping installation.
- 2.5 Exhaust volume connections shall be located at the top of the ESG1 to serve ease of the exhaust piping installation.

3.0 Heat Exchanger Section:

- 3.1 Explosion-proof heating surface to be nickel brazed/welded fin to tube, for high heat transfer and corrosion protection (.109 wall thickness x .030 minimum fin thickness).
- 3.2 The finned tubing shall be designed in multiple sections for ease of replacement.
- 3.3 The heat exchanger section shall contain a main inspection door for tube removal and a main inspection access port for cleaning and/or inspection.
- 3.4 The reinforced enclosure shall contain 304 stainless steel baffles with 4" minimum thickness thermal insulation. The enclosure shall be designed to operate with exhaust temperatures entering @ 1,250°F maximum (1600°F design available) and shall have a gas tight seal with continuously welded 10ga. carbon steel exterior: Design Pressure (exhaust side): 10 inches water column, primed/painted with high temp. metallic paint.

4.0 Modulating Bypass Assembly:

- 4.1 The modulating bypass assembly shall be constructed of minimum .25" thickness plate steel (stainless steel available) and the exhaust connections shall be 150 lb. design SA105 exhaust flanges when applicable. The bypass assembly shall be bolted to the heat exchanger section for ease of maintenance. Insulation shall be provided by others as needed.
- 4.2 The bypass shall be controlled by a modulating pneumatic positioning actuator and steam pressure dial controller, for controlling the volume of waste heat exhaust as dependent on steam pressure.
- 4.3 The reinforced damper assembly shall be constructed of 304 stainless steel and designed for tight seal during the full bypass.
- 4.4 The 304 stainless steel damper shaft shall contain high temperature bearings and packing glands to seal exhaust leakage.
- 4.5 In the event of an air pressure or electrical failure to the ESG1, the modulating bypass assembly shall contain a alarm fail safe operating mode, whereby the damper assembly shall automatically move to the full exhaust bypass position.

5.0 Steam Flash Drum & Control Assembly:

- 5.1 The steam flash drum assembly shall contain internal baffles and dry pipes for 99% dry steam output, and 1" thick thermal insulation with minimum 16ga. carbon steel exterior and shall include the following:
 - 5.1.1 The ANSI standard configured circulating pump and TEFC motor shall be incorporated to maintain high water flow turbulence for minimum fouling.
 - 5.1.2 The blowdown valving shall include a main drum blowdown valving assembly including quick opening and shut off valves, continuous surface blowdown valve, and water level control blowdown valve all manifolded for a single blowdown connection.
 - 5.1.3 Safety controls to include low/high water cutout, excess steam pressure cutout, low air pressure cutouts (for pneumatic exhaust bypass actuator).
 - 5.1.4 The water level control system shall contain fully modulating boiler feedwater pump level control and valve assembly with boiler feedwater on/off auxiliary switch.
 - 5.1.5 Water level control to contain red line water level sight glass with drain cock.
 - 5.1.6 All required gauges for steam (4 1/2" dial minimum), feedwater, pump cooling water, and air indication (2 1/2" dial minimum) shall be provided.
 - 5.1.7 (1) ASME and National Board stamped steam safety relief valve.
 - 5.1.8 All necessary interconnecting piping linkages and valving shall be provided.
 - 5.1.9 All inner connecting piping shall be insulated by others as required.
- 5.2 Control panel to be NEMA 12 construction to accept a single main power connection with main fuse disconnect and starter, fuse-protected stepdown transformer, power and run indicating lights, fill indicating light, low & high water alarm indicating lights, and low air & excess steam pressure lights.



Testing of all components, electrical controls, and hydrostatics as a system, is completed prior to shipment, insuring a smooth and efficient field startup.



Final inspection, under the strict guidelines of Cain Industries and ASME quality control standards, is conducted for each unit.



Complete packaged units are shipped for immediate installation upon arriving on site.



Field startup and operator training is realized quickly with factory trained personnel.